ARMY REGULATION
No. 602-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *4 March 1968*

MAN-MATERIEL SYSTEMS
HUMAN FACTORS ENGINEERING PROGRAM

1. Purpose. This regulation prescribes policies and procedures and assigns responsibilities for human factors engineering (HFE) in the Department of the Army. For the purpose of this regulation, HFE is defined as a comprehensive technical effort to integrate all manpower characteristics (personnel skills, training implications, behavorial reactions, human performance, anthropometric data, and biomedical factors) into all Army systems.

2. Scope. *a.* This regulation applies to Headquarters, Department of the Army, agencies and major field commands responsible for—

(1) Development of organization and doctrine.

(2) Materiel requirements.

(3) Research, development, test, and evaluation of materiel.

(4) Production and procurement of materiel.

(5) Management of personnel resources.

(6) Training or development of manpower.

(7) Systems safety engineering.

b. HFE includes—

(1) That part of system analysis that determines man's role in a man-materiel system.

(2) Selection, definition, and development of man-materiel interface characteristics, workspace layout and work environment conducive to effective and efficient performance under expected use conditions.

(3) Determining the needs for, and then developing and evaluating job procedures, performance aids, and training devices, aids, equipment, and publications.

(4) Providing basic man-machine task sequence data used to describe, develop, and assess the feasibility of the human performance required in a man-materiel system.

(5) Developing equipment which permits effective man-equipment interaction under special limitations in the training time, aptitudes, skills, or physical standards.

(6) Determining number and kinds of military and civilian personnel needed in a man-materiel system for cost effectiveness analyses when evaluating various design concepts and for subsequent personnel planning, and providing the data needed for modifying current MOS or establishing new MOS required by new equipment, doctrine, or organization.

(7) Assessing the training burden which competing materiel design concepts may impose on the Army.

(8) Developing the information needed for new or revised training plans, courses, or programs of instruction as required by new or modified materiel, doctrine, or organization.

(9) Assessing HFE as described above by evaluating the man-equipment combination.

3. Objectives. The objectives of the HFE program are—

a. The integration of human performance into system design to achieve the most effective, efficient, and reliable man-equipment combination under use conditions.

b. To insure that materiel is developed so that the human tasks involved in operating, maintaining, and supplying the Army's equipment and weapons do not exceed the capabilities of the manpower resources available to the Army.

c. To insure that training on specific equipment is feasible, effective, sufficient, necessary, and integrated into the Army training program.

d. To improve control of total life cycle costs of man-materiel systems by assuring consideration, early in the materiel life cycle, of the cost of manpower resources and training for alternative systems.

e. To reduce skill levels, training, and manpower required by equipment.

f. To develop human performance data, integrate it with system performance data, determine new performance requirements, evaluate personnel feasibility, and provide for the timely development of the necessary trained manpower resources.

g. To insure that systems safety engineering is considered.

h. To provide data for the development of technical manuals, training manuals, field manuals, and other technical publications and insure that the use of these publications does not require aptitudes, education, or training beyond that required to perform the tasks they describe.

i. To apply HFE concepts and current educational technology to design and development of training devices.

4. Policy. *a.* HFE will be employed to integrate materiel development and personnel or manpower resources during all phases of the life cycle for materiel. HFE will also be used in determining or evaluating the kind, quality, format, and level of publications for materiel developments.

b. Personnel implications will be considered throughout all development activities. Human factors studies or behavioral research will be initiated if novel human factors problems are identified in Army development programs. See AR 70–8.

c. HFE will be initiated as part of the development of a Qualitative Materiel Development Objectives (QMDO). Agencies or commands preparing a QMDO will apply HFE to assess organizational concepts. The HFE process which applies to this stage includes tentative identification, allocation, and sequencing of operator and maintenance tasks to develop a concept of man's role in operating, using, or maintaining the equipment. These data will be used to assure that personnel implications are considered in arriving at estimates of desired levels of operational capability, reliability, and maintainability as stated in the QMDO. Research and development in support of a QMDO will include human factors research if necessary, and the identification of HFE guidelines, standards, processes, or criteria that will be required to insure that operational performance objectives for the man-materiel system can be achieved by the personnel that will be available to the organization employing the system. Special training requirements may also be identified in the QMDO. Human factors effort applied in developing the QMDO will be described in the QMDO plan.

d. Human factors research or engineering will be continued to insure the timely consideration of human factors in materiel development throughout exploratory development, advanced development, and the preparation of a Qualitative Materiel Requirement (QMR) or a Small Development Requirement (SDR). Human factors research or engineering during these phases of development will include more detailed task allocation and further refinement of operator and maintenance task sequences. These task sequences will be used to determine skill and training implications and their impact upon organizational structure.

e. Provisional qualitative and quantitative personnel requirements information will be based on:

(1) Analysis of planned task sequences,

(2) The skills or knowledge required by these tasks,

(3) The personnel performance standards necessary to meet operational objectives, and

(4) Special personnel implications identified during the preceding phases of the research and development cycle. Provisional qualitative and quantitative personnel requirements information and Army capability to man organizations to these requirements will be considered in determining and approving initial basis of issue and unit structure.

f. Estimates of life cycle personnel costs, including training costs and projections of personnel availability, will be explicitly considered in cost effectiveness analysis.

g. Maintenance characteristics, human engineering characteristics, and personnel and training considerations included in the QMR will reflect previous HFE analysis. QMR format is specified in AR 71–1. Human engineering characteristics specified in the QMR should emphasize effectiveness, objectives, and personnel support limitations, rather than specific design requirements. Human engineering standards which embody well tested human factors principles or prescribe design standardization to minimize cross training or relearning problems are appropriate as guidelines. These standards should not preclude design approaches

which can lead to improved performance of man-materiel system

h. HFE will be applied to succeeding planning, design, and development phases. Heads of developing agencies and system and project managers will include HFE plans, personnel plans and training development plans in the project master plan and system development plans as appropriate. Development of HFE plans requires for each system a thorough systems engineering analysis of the system requirements and consideration of the state of the art in HFE. Personnel plans will describe actions, decisions, and processes necessary to staff the organizations which employ or support the system. Training development plans will address all training required for the specific system and the impact of the system on other training. The project manager charter will indicate personnel spaces on the project manager's team that provide for HFE management, personnel planning, and training development.

i. During contract definition, HFE, personnel plans and training considerations will be integrated into the technical and management plans. Performance criteria for the man-materiel system are the preferred method for specifying the development objective for human factors and training. When performance criteria cannot be specified or compliance with performance criteria demonstrated, HFE specifications will include one or more of the following:

(1) Human engineering design standards.

(2) Experimental or simulation procedures.

(3) Application of proven designs.

(4) Qualifications of the human factors team and the team's role in the system analysis and design procedure.

HFE data developed during contract definition will be considered during this phase in determining personnel requirements and in planning development of personnel support programs and training programs.

j. Plans for the evaluation of HFE will be included in test plans as described in AR 70–10. To evaluate HFE, system testing should obtain man-materiel system performance data which permit estimates of human performance reliability expected in operational situations involving typically manned organizations.

k. During all phases of system development, the interactive effect of system concept, hardware design, personnel performance requirements, and training requirements must be recognized. Decisions regarding mission, doctrine, basis of issue, unit organization and manning, personnel selection and training, HFE design, and technical or training publications will be made from a common data base. Task sequences developed originally for man-materiel task allocation and determination of personnel feasibility will be used to the maximum extent feasible in:

(1) The determination of man-materiel interface requirements (displays, controls, or test points);

(2) The development of new or revised MOS or duty descriptions (AR 611–1);

(3) The development of training programs and standards; and

(4) The preparation of technical publications.

Whenever design or configuration changes affect previously developed personnel data, the personnel data base will be brought up to date. HFE will be applied to planning and making changes in missions, doctrine, organizations, and equipment to avoid man-materiel incompatibility.

5. Responsibilities. *a.* The Deputy Chief of Staff for Personnel (DCSPER) will—

(1) Review and monitor plans (e.g., QMDO plan, System Development Plan) and activities in materiel development which affect personnel or training to assure the appropriate application of HFE in the development of human performance requirements. He will coordinate actions with the Chief of Research and Development and the Assistant Chief of Staff for Force Development.

(2) Provide to developing agencies current and projected planning figures on personnel resources, including normative information on mental level, medical standards, military experience, MOS and grade level, and impact on manpower of new personnel requirements.

b. The Deputy Chief of Staff for Logistics (DCSLOG) will—

(1) Insure integration of HFE in the development of logistics systems.

(2) Insure the provision for all systems of human factors requirements for logistic charac-

teristics (e.g., packaging, handling, maintenance, and identification).

(3) Insure verification of the adequacy of logistic HFE prior to the completion of production acceptance tests or direct procurement.

(4) Insure continuation of HFE in system modifications.

c. The Chief of Research and Development will—

(1) Provide nonmateriel behavioral sciences research support to insure a necessary scientific basis for HFE.

(2) Insure appropriate and systematic application of HFE throughout the development cycle.

(3) Provide for professional coordination among human factors specialists and behavioral scientists through the Army Behavioral and Social Sciences Development Committee and the Army Human Factors Research and Development Conference as described in AR 70–8.

d. The Assistant Chief of Staff for Force Development, in coordination with the DCSPER and the DCSLOG, will—

(1) Insure the application of HFE in combat developments and in the review of development objectives for total feasibility.

(2) Insure the consideration of relevant HFE data in manpower allocation, in establishing requirements for new equipment training and unit training, and in developing tables of organization and equipment and tables of distribution and allowance.

e. Responsibilities of developing agencies are as follows:

(1) The Commanding General, U.S. Army Materiel Command, will establish a comprehensive HFE program which will integrate into materiel development inputs from Army personnel, training, medical and research agencies to include:

(*a*) Development and coordination of HFE procedures, standards, and specifications.

(*b*) Orientation of system, project, and product managers.

(*c*) Providing human factors specialists to materiel development programs.

(*d*) Improvement of Army capability for HFE management.

(*e*) Performance of appropriate human factors research or development tasks.

(2) Chiefs of other agencies assigned responsibility for development of materiel items, i.e., Commanding General, U.S. Army Strategic Communications Command; Commanding General, U.S. Army Security Agency; the Chief of Engineers; and The Surgeon General, will establish HFE programs which incorporate the above provisions as appropriate to their development responsibilities and are compatible with the program of U.S. Army Materiel Command.

f. The Commanding General, U.S. Army Combat Developments Command, will—

(1) Insure that HFE is considered in doctrinal studies and in planning the future materiel development program.

(2) Insure that QMDO, QMR, and SDR include adequate specification of HFE requirements and that these requirements reflect realistic objectives in terms of the state of the art, doctrine, life cycle effectiveness, and anticipated user requirements.

(3) Insure that user input to HFE is provided to developing agencies.

g. The Commanding General, U.S. Continental Army Command, will—

(1) Participate in the development of HFE programs in support of materiel developments.

(2) Establish requirements for human performance information necessary for the development of training plans and programs.

(3) Evaluate these data in developing a command position for system status evaluations.

(4) Recommend, when appropriate, to the DCSPER research and development projects in the field of education and training brought about by HFE considerations involving unusual skills or learning processes.

(5) Furnish training experience inputs and training advisors as needed to the HFE effort.

The proponent of this regulation is the Office of the Deputy Chief of Staff for Personnel. Users are invited to send comments and suggested improvements to Deputy Chief of Staff for Personnel, ATTN: DCSPER–PRD, Department of the Army, Washington, D.C. 20310.

By Order of the Secretary of the Army:

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Distribution:
To be distributed in accordance with DA Form 12–9 requirements for Administration:
Active Army: D. *NG:* None. *USAR:* D.

U.S. GOVERNMENT PRINTING OFFICE: 1968